CFN Center for Functional Nanomaterials

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Brookhaven National Laboratory

Nanoscale Science Research Centers

- Center for Nanoscale Materials, Argonne National Laboratory
- The Molecular Foundry, Lawrence Berkeley National Laboratory

Department of Energy Office of Science

- Center for Nanophase Materials Sciences, Oak Ridge National Laboratory
- Center for Integrated Nanotechnologies, Sandia National Laboratories, Los Alamos National Laboratory

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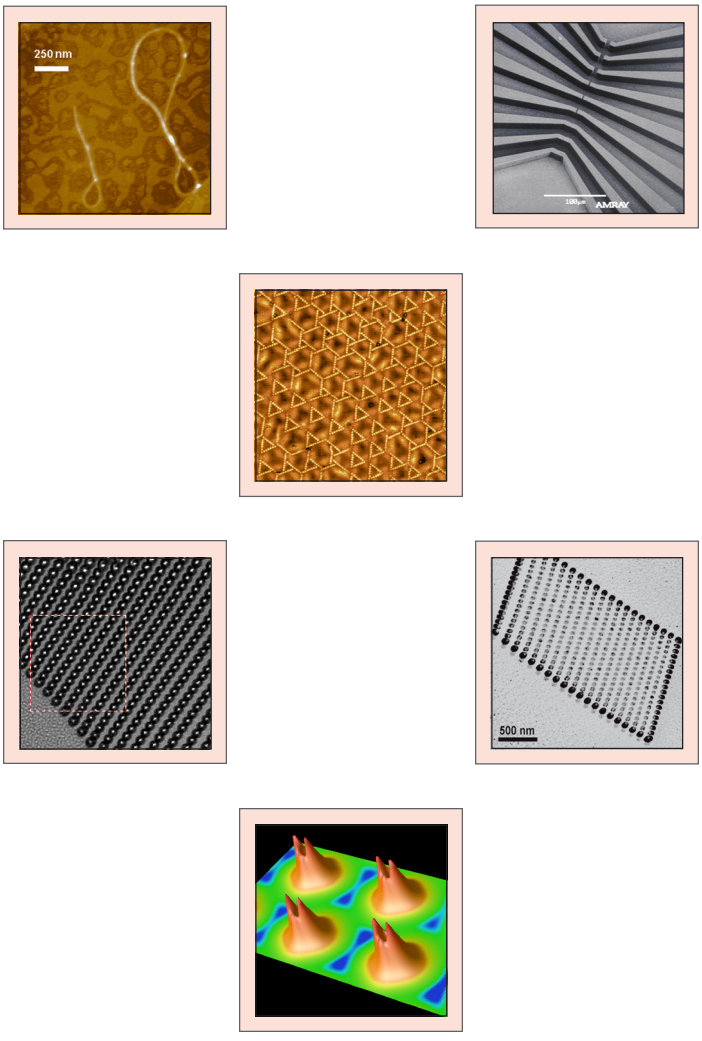
Brookhaven National Laboratory



The Brookhaven National Laboratory Center for Functional Nanomaterials (CFN) is one of five centers, called Nanoscale Science and Research Centers, to be located at U.S. Department of Energy (DOE) national laboratories and managed by DOE's Office of Science. The CFN will provide scientists from universities, industry and government laboratories with state-of-the-art capabilities to fabricate and study nanoscale materials, which are the size of a few billionths of a meter. Such materials offer different chemical and physical properties than bulk materials, and could thus form the basis of new technologies. Operated as a national user facility, the CFN will emphasize atomic level tailoring of nanomaterials to achieve desired properties and functions.

Scientific Themes

Initially, the CFN will focus its science and technology research efforts on six scientific areas:

- **Strongly correlated oxides:** examining changes in the electronic response of metal oxide nanomaterials.
- **Magnetic nanoassemblies:** investigating magnetic interactions in nanomaterials.
- **Nanocatalysts:** studying ways to form catalysts – materials used to speed chemical reactions – and examining their electronic structure and reactivity.
- **Charge injection and transport:** studying electronic conduction in molecular wires, nanocrystals and nanodots.
- **Nanometer-thick organic films:** investigating how thin organic films self-assemble into structures that have better mechanical, electronic, and optical properties, and how these films could be used as lubricants, adhesives, and to enhance chemical selectivity.
- **Nanoscience applications:** building new devices, such as nanoscale electronic materials, ultra-thin film optical devices, and advanced fuel cell catalysts.

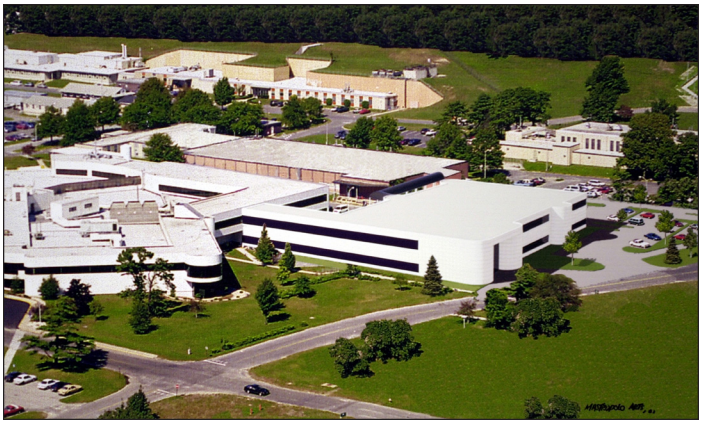
Facilities and Capabilities

The CFN, expected to be fully operational in 2007, will be housed in a building consisting of offices and laboratories, and will be located adjacent to the National Synchrotron Light Source (NSLS). The centerpiece of the facility will be composed of five state-of-the-art groups of laboratories, called Laboratory Clusters, a Theory and Computation Center, and a set of state-of-the-art endstations on beamlines at the NSLS.

The Laboratory Clusters will include advanced capabilities in nanopatterning, transmission electron microscopy, nanomaterials synthesis, ultra-fast laser sources, and powerful probes to image atomic and molecular structure, together with clean rooms and other support instrumentation. These capabilities are currently being set up within the Physics, Chemistry, Materials Science and Instrumentation Buildings. The NSLS endstations will be specialized for micro-imaging and small-angle scattering.

As part of the CFN, BNL also offers access to other key national facilities for studying the properties of nanomaterials, including the NSLS, the laser-electron accelerator facility (LEAF) and a transmission electron microscope facility, in addition to the scientific staff and collaborating university scientists associated with them. Each of these three facilities offers unique and important advantages. For example, the NSLS offers a complete set of scattering, spectroscopy and imaging capabilities in the hard x-ray, soft x-ray and infrared wavelength ranges. Also, LEAF is the fastest facility in the country for studying the kinetics of radiation-induced reactions, also called pulse radiolysis, making LEAF ideal for studying charge injection into and charge transport between molecules.

Before the CFN becomes fully operational, access to all existing nanoscience facilities will be available for users in the developing Laboratory Clusters, the Theory Center, LEAF, and on beamlines at the NSLS, following a Call for Proposals in March 2003 (see www.bnl.gov/nanocenter/ for more details).



Architectural rendering of the Brookhaven Center for Functional Nanomaterials (right), adjacent to the National Synchrotron Light Source (front, left) and the Instrumentation Division building (rear, left).

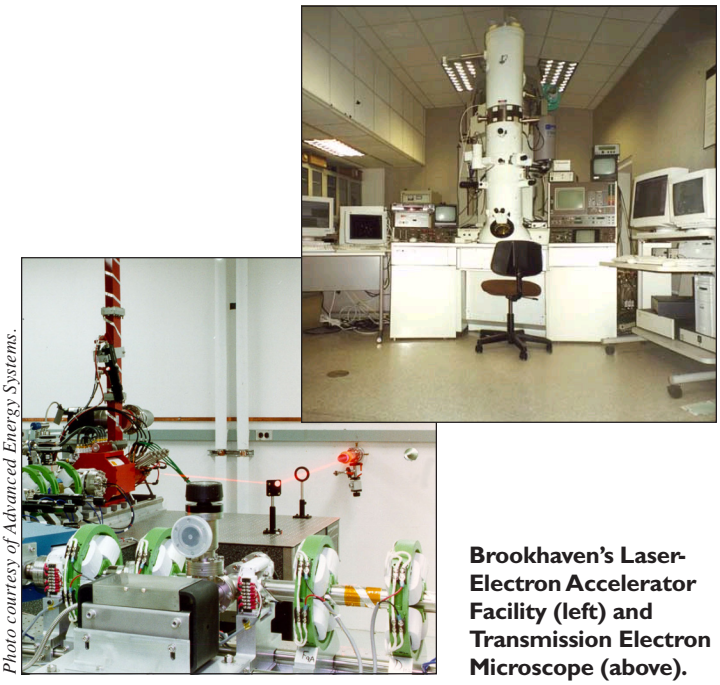


Photo courtesy of Advanced Energy Systems.

Brookhaven's Laser-Electron Accelerator Facility (left) and Transmission Electron Microscope (above).

User Program

The CFN will be operated as a national user facility, accessible to researchers at universities, industrial laboratories and national laboratories through peer-reviewed proposals. The user program will provide access to state-of-the-art Laboratory Clusters and related facilities staffed by laboratory scientists, postdocs and technical support personnel who are active in nanoscience research. The number of users will grow from modest levels in the first year, following the initial Call for Proposals in March 2003, as the new facilities are constructed and commissioned in the succeeding years. We invite proposals from external scientific and industrial communities that involve a broad spectrum of activities ranging from short-term capability access to long-term joint research programs.

The Department of Energy's Brookhaven National Laboratory conducts research in the physical, biomedical, and environmental sciences, as well as in energy technologies. Brookhaven also builds and operates major facilities available to university, industrial, and government scientists. The Laboratory is managed by Brookhaven Science Associates, a limited liability company founded by Stony Brook University and Battelle, a nonprofit applied science and technology organization.

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